

### Abstract

Methods and apparatus for constructing phased array antenna beamforming networks are provided, that allow to scan multiple beams and select appropriate sets of delay lines simultaneously. The beamforming networks disclosed herein generate less losses than

5 conventional ones and in some cases, do not require active switching, making them completely passive. Three main methods are comprised in the invention : (1) laser wavelength hierarchies, (2) arrangements of Wavelengths Division Multiplexing (WDM) components, (3) re-use of laser wavelengths. Multiple laser wavelengths are arranged in groups and subgroups (wavelength hierarchies) in the wavelength domain. By switching between these wavelength groupings, the

10 arrangements of WDM components disclosed herein enable the beamforming network to direct the beam signals to the proper time delay lines, and to differentiate multiple beams. The method of laser wavelength re-use permits to significantly reduce the number of wavelengths utilized, and thus to limit them to the standard wavelengths specified by the ITU.